

How it works



Hedy Lamarr 1944

- Hedy Lamarr was a trendy Austrian-American Film actress and inductee into the National Inventor's Hall of Fame for her work on radio frequency-hopping spread spectrum radio-guided torpedoes used in WW II. Her invention received [U.S. Patent 2,292,387](#). This method of hiding radio messages entails transmitting small parts of a message on different radio channels. The transmitter and receiver agree on a list of channels that will be used to send and receive the message. When the first bit of the message is transmitted on the first channel in the list, the transmitter and receiver switch their radios to the next channel on the list. Each bit of the message is sent over a different radio channel until the entire message has been sent. The message cannot be easily intercepted if the list of channels is kept secret from a hacker. This activity generates the channel list from a private key shared between the sender and receiver.

What will you do?

1. Practice making a channel Python list:
 - a. Each group member should advance to the page with '**practice_short_key.py**' and run the program.
 - b. Advance to the page '**practice_long_key.py**' programs.
 - c. These two programs each make a channel list that depends on the key. What is the difference between the outputs of the two programs? Does a short key or a long key generate more channels? Which channel list would be more secure?
2. Texting a message using frequency hopping spread spectrum:
 - The **receiver**:
 - Advance to '**student_receiver.py**,' change the group to their assigned number, and run the program **before** the sender has run theirs.
 - The **sender**
 - Advance to the '**student_sender.py**,' change the message string and group to their assigned number, and then run your program **after** the receiver and hacker have started theirs.
 - The **hacker**
 - Advance to '**student_hacker.py**,' change the group to their assigned number, and run the program **before** the sender has run theirs.
 - After your team runs the activity, the sender should change the **message** and **key** and share the key only with the receiver. Don't tell the hacker the new key; **keep it private**! Can the hacker read your message in cleartext as they did in the 'All Clear' activity?

Code it

Sender role

```

2.1 2.2 3.1 2 - Cyber...ing RAD 1/11
from microbit_radio import *
from frequency_hopping import *
# The channel_list and group must be the same
# as the receiver.
group = 1
key = "Timbuktu"
channel_list = make_channels_list(key)
message = "The gold is in the cookie jar!"
clear_history()
print("\nmessage=",message)
tx(message,channel_list,group)

```

Receiver role

```

2.2 3.1 3.2 2 - Cyber...ing RAD 1/11
from microbit_radio import *
from frequency_hopping import *
# The secret key and group must be the same
# as the receiver. The channel will automatically
# change as the program runs.
group = 1
key = "Timbuktu"
channel_list = make_channels_list(key)
clear_history()
message = rx(channel_list,group)
print("\nmessage=",message)

```

Hacker role

```

3.1 3.2 3.3 2 - Cyber...ing RAD 1/11
student_hacker.py saved successfully
from microbit_radio import *
from frequency_hopping import *
# The secret key and group must be the same
# as the receiver. The channel will automatically
# change as the program runs.
group = 1
key = "Zanzibar"
channel_list = make_channels_list(key)
clear_history()
message = rx(channel_list,group)
print("\nmessage=",message)

```

Go further

- Rerun the activity in a different team role.
- Repeat the activity using different keys and messages.
- Try to discover how many channels are on the list for a given key.

Check your understanding

- For two radios to communicate, they must be on the same channel and group.
- A transmitting program can switch the channel after sending each character.
- A receiving program must know the channels the transmitter will use to send the message ahead of time.
- Using a frequency channel hopping algorithm, like the one in this activity, can make hacking more difficult.

Help

- Check that everyone on the team is using their assigned group number.
- Ensure the receiver and hacker run their programs and wait before the sender transmits the message.
- Ensure the sender and receiver use the same key.
- Ensure the hacker does know the key.